

The significance of the anterior mastoid tubercle in the phylogeny of middle to late Pleistocene *Homo*.

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The Neandertal taxon (*Homo sapiens neanderthalensis* or *Homo neanderthalensis*) is commonly defined using a number of apomorphic traits observed on fossil samples. In many cases, these fossil samples have been classified *a priori* as Neandertal. An illustration of this is found in the treatment of the anterior mastoid tubercle, which has been categorized as an important Neandertal autapomorphy in the systematic literature. It is expected that a definitive Neandertal trait would be ubiquitous throughout the Neandertal fossil sample, and that its distribution be restricted to a Neandertal clade in a well-supported phylogeny.

A study documenting the distribution of the anterior mastoid tubercle among Neandertal and modern human samples was undertaken. This study reveals that the trait is entirely absent in the largest fossil collection commonly assigned to the Neandertal taxon, that from Krapina, Croatia, which includes 15 temporals preserving the mastoid region. Further examination of a number of Western European Neandertal fossils ($n=7$), including specimens upon which the trait was originally identified, suggests that this trait is extremely variable even among these specimens. In addition, the anterior mastoid tubercle is difficult to define and to score. Examination of a sample of modern human specimens from Iran ($n=300$) documents the variation which is present in this character, provides a basis for its explicit definition, and indicates that it is found at fairly high frequencies in at least some modern human populations.

Assigning taxonomic significance or derived status to morphological characters in the absence of agreement upon the proper composition or phylogeny of the groups in question is a practice which assumes phylogeny rather than revealing it. The results of this comparative study reveal a distribution of the anterior mastoid tubercle which is not congruent with that expected for a "derived Neandertal trait."

Why are Chinese shorter than Europeans: The Chinese side of the story. H. CHEN and B.Q. HUANG, Department of Orthopaedics, The Hospital of Chinese Medicine, ShiQiao, Guangdong 511400, People's Republic of China.

Two major hypotheses have been advanced to explain the stature difference between Chinese and Europeans. One hypothesis states that Chinese have a more rapid maturation rate during puberty and hence a shorter adolescent growth period. The other hypothesis proposes that Chinese reach their puberty earlier and thus have less time to grow before the growth spur. A recent study using data from Taiwan has given

support to the second hypothesis (Floyd, 1997). We investigated this problem using a larger data set from the mainland China.

Stature data were collected from the Chinese literature published in the last 35 years. Samples from the 1985 national physique survey were also included (Zhu, 1985). In addition, data from separate surveys in eight major cities were used in the analysis.

While the analysis has provided some support to the second hypothesis, it has also yielded the following results that are inconsistent with the hypothesis: (1) Many Chinese groups do not show significantly earlier age of puberty than Europeans. (2) Despite the fact that the age of puberty becomes consistently earlier in nearly all Chinese samples in the last 50 years, the stature of the populations has increased greatly. (3) Despite a consistently later age of puberty, rural samples show a shorter stature than affluent urban ones within the same geographic regions. (4) While most of the samples from South China do not display an earlier age of puberty, they nevertheless have a shorter stature than the samples from the northern part of the country.

Our results therefore suggest that the reason for Chinese being shorter than Europeans may be complex. Both hypotheses may well be correct depending on specific populations.

From nose to brain. B.A. CHIARELLI, Institute of Anthropology, University of Florence, via del Proconsolo 12, 501122 Firenze, Italy.

As is the case for most other primates, humans have a poorly developed sense of smell, i.e., they are microsmatic. One might therefore assume that communication through olfaction has little relevance in human social behavior. This is not the case, however. Each individual produces a unique odor caused by the interaction of cutaneous bacterial flora with substances produced by cutaneous glands. Size and the production of these glands are under the influence of gonadal hormones. Furthermore, each individual produces chemical substances of low molecular weight, or pheromones, which can influence the behavior of other individuals unconsciously, and even cause them to undergo physiological changes. In addition to differences in glandular products related to olfaction, there are also differences in the perception of smell in relation to sex, stage of female reproductive cycle, and age. Details are provided about the influences of odors on the behaviors of human receivers. In sum, the neurophysiological pathway by which odor influences behavior is charted from the initial stimulation of the sensory terminals in the vomeronasal region of the human nose, to the subsequent stimulation of the olfactory bulb of the brain. Despite the fact that pheromone research is recognized as an important area for the field of mammalian brain evolution, it has not yet received the full attention that it deserves in anthropological and sociological investigations.

Colonization and microevolution in the Rio Verde Valley, Oaxaca, Mexico. A.F. CHRISTENSEN, Vanderbilt University, Nashville, TN 37235.

The Rio Verde Valley, on the Pacific coast, was the locus of the second largest urban area in the modern state of Oaxaca, Mexico, during the Classic period (A.D. 300-800). While the highlands of the state have archaeological evidence of settled populations dating to the Early Formative (1700 B.C.), the earliest remains in the Verde date to approximately 500 B.C. Archaeological, epigraphic, and linguistic evidence suggests that the first settlers of the Verde were related to the proto-Zapotec population of the Valley of Oaxaca. A multivariate examination of 23 cranial non-metric traits confirms the relationship between the Formative remains from the Valley and the available coastal sample, which has more distant affinities to series from the Mixteca Alta. Odontometric analysis also provides some support for this relationship, but highlights one clear distinction between the coast and all highland samples: the lowland dwellers have dramatically smaller teeth. An earlier study (Christensen, *J. Hum. Evol.*, in press) has documented a steady reduction in overall tooth size in the Valley of Oaxaca, from a total crown area (TS) of 1320.1 mm² in the Early Formative to 1262.0 mm² in the Postclassic (A.D. 800-1521). Yet the complete sample from the Rio Verde, dating largely to the Late Formative with some Classic admixture, has a TS of 1216.8 mm². Assuming an ultimate derivation of the Verde population from that of the Early Formative Valley of Oaxaca, this indicates an average evolutionary rate of 25.5 darwins for tooth lengths, 30.8 for breadths, and 28.0 for areas. Assuming an h^2 of 0.5 for tooth dimensions, selective mortality of approximately 0.005 would be required to cause this change. These unusually high rates are probably the consequence of the initial colonization by a small highland population of a lowland area with a dramatically different environment that produced strong selective pressures towards reduction. This study illustrates the value of examining multiple systems of phenotypic variation, as one of the systems chosen was subject to strong natural selection while the other appears selectively neutral. Between them, they provide a broader picture of the biological history of the region.

Metacarpals of *Australopithecus afarensis*: locomotor implications of cross-sectional geometry. K.E. COFFING, Department of Anthropology, University of California at Los Angeles, Los Angeles, CA 90095-1553

There is continuing debate about the degree of arboreality in *A. afarensis*. Arboreality requires the active use of hands. Adult modern humans are unique in not using hands regularly during locomotion, in contrast to all other extant primates. This functional difference should be correlated with the cortical structure of hand bones, since bones are remodeled during life in response to mechanical stress. The thickness and distribution of cortical bone in the metacarpals of extant primates has been examined and compared with that of *A. afarensis* to discern the internal structure and

function of the hand of *A. afarensis* and give evidence about its locomotor repertoire.

Biplanar radiographs and putty molds of the shafts of metacarpals I-V were taken of extant *Gorilla*, *Homo*, *Hylobates*, *Nasalis*, *Pan*, *Papio*, and *Pongo* (n= 13 to 24 of each genus). Measurements of bone strengths (based on engineering beam theory) were calculated from a combination of radiograph cortical thickness and periosteal shape data from the molds. The *A. afarensis* (n=11) and *Proconsul hesloni* (n=4) fossils were radiodense, so photographs of fractures were used to calculate both cortical thicknesses and periosteal shapes. All resulting data were compared with calculations of individual body mass from femoral head diameters, metacarpal length, published species and subspecies sex-specific body mass means, and/or known body masses when available.

In the pattern of cortical area : total area across the metacarpus, *A. afarensis* differs from modern humans and resembles *Gorilla*, *Hylobates*, *Pan troglodytes*, *Pan paniscus* and *P. hesloni*. *Pongo pygmaeus* shows a separate pattern, as does a group formed by *Papio* and *Nasalis*. *A. afarensis* shows consistently high J (a measure of average bending rigidity and torsional resistance) against both metacarpal length and literature body mass estimates. *A. afarensis* is similar to humans in J v. metacarpal length, but differs from humans in J v. body mass, particularly on the ulnar side of the metacarpus. Metacarpal length vs. body mass appears to demarcate arboreal and terrestrial locomotor types. The range of estimated body mass of *A. afarensis* affects its apparent locomotor affinity. Functional and locomotor implications will be discussed.

This research was supported by a National Science Foundation Dissertation Improvement Grant and The Johns Hopkins University.

Morphometric modeling of evolutionary form change. TM COLE III, University of Missouri, Kansas City, MO 64108; MA O'LEARY, SUNY, Stony Brook, NY 11794; S LELE and JT RICHTSMEIER, The Johns Hopkins University, Baltimore, MD 21205.

While landmark-based morphometrics have become increasingly popular in the study of evolution, relatively little effort has been made to develop methods compatible with quantitative genetic and evolutionary theories. To address this problem, we present new methods for modeling stochastic change in complex forms, as well as for modeling change under different selection regimes. As an applied example, we analyze evolutionary change in early notharctine (Adapidae) tooth form.

Our method uses the following algorithm: An ancestral population is measured using homologous landmarks, and the mean form and the among-landmark variance-covariance matrix are estimated. Assuming a multivariate normal distribution, stochastic form change in a lineage is then simulated as a moving-average random process. A sample of simulated lineages serves as a null model for detecting nonrandom trends in fossils. Alternatively, we can model directional or stabilizing selection acting on an index of interlandmark distances (e.g., selection for larger "size").

For the notharctine example, we model evolution in M_1 form, using *Pelycodus ralstoni* as an ancestor. One thousand random lineages are simulated for a three-million-year sequence (with an estimated generation time of four years and effective N of 25, 100, or 500). The morphological "corridor" traversed by the random lineages is fairly restricted, probably as a result of high covariances among landmarks. However, the simulated forms become markedly different from both *P. ralstoni* and later *Pelycodus* species, suggesting that the sizes and shapes of notharctine teeth were influenced by directional selection, rather than varying under strictly random processes.

Supported by NSF grants DBS 9209083 and SBR 9316019.

Cladistics and the estimation of hominid phylogeny. M. COLLARD and B. WOOD, Anthropology, UCL, London. and Anthropology, GWU, Washington DC.

Are current cladistics-based estimates of hominid phylogeny dependable? This question was addressed with analyses of cranial data from two primate taxa whose genus-level phyletic relationships have been reliably reconstructed from molecular evidence: the Hominoidea and Papionini.

Analyses 1-24 used values for 129 measurements recorded on mixed-sex samples of *Gorilla*, *Homo*, *Pan*, *Pongo* and two outgroups. In analyses 1-11, matrices were derived from these data using different combinations of variables, outgroups, size-adjustment methods and coding procedures. Parsimony analyses were performed on the matrices, and the most-parsimonious trees compared with the hominoid molecular tree. In analyses 12-13, the matrices assembled in analyses 9-10 were subjected to compatibility analyses, and the favoured trees compared with the hominoid molecular tree. In analyses 14-24, the matrices prepared in analyses 1-11 were bootstrapped, and the $\geq 70\%$ clades compared with the clades of the hominoid molecular tree.

Analyses 25-44 used values for 62 measurements recorded on mixed-sex samples of the extant papionins and four outgroups. In analyses 25-33, matrices were derived from these data using different combinations of outgroups, size-adjustment techniques and coding methods. Parsimony analyses were carried out on the matrices, and the most-parsimonious trees compared with the papionin molecular tree. In analyses 34-35, the matrices assembled in analyses 30-31 were subjected to compatibility analyses, and the favoured trees compared with the papionin molecular tree. In analyses 36-44, the matrices prepared in analyses 25-33 were bootstrapped, and the $\geq 70\%$ clades compared with the clades of the papionin molecular tree.

None of the most-parsimonious trees recovered in the parsimony analyses and none of the trees favoured in the compatibility analyses was congruent with the molecular trees. Similarly, none of the $\geq 70\%$ clades recovered from the bootstrap analyses matched the clades of the molecular trees. This suggests that current cladistics-based estimates of hominid phylogeny are unreliable. Most probably, they

reflect the effects of convergence, parallelism and/or reversal rather than evolutionary propinquity.

Supported by the NERC and the Wellcome Trust.

Discriminant functions for the estimation of sex: carpal and tarsal metric data from the prehistoric Windover skeletal population. K.C. HOOVER, Department of Anthropology, Southern Illinois University, Carbondale, IL 62901-4502.

Historically, the bones of the hands and feet have been overlooked by osteologists and archaeologists. Steele (1970) demonstrated statistically significant sexual dimorphism in talus and calcaneus metric data from the Smithsonian's Terry Collection. Discriminant functions were between 83-89% accurate. Encouraged by Steele's results, this research evaluates the hypothesis that statistical analysis of metric and nonmetric features of eight carpal and tarsal elements demonstrate significant sexual dimorphism to be used as an alternate model of sex estimation.

Twenty-eight metric and seven nonmetric features collected from the Archaic Windover skeletal population of Florida comprise the data set. In an attempt to select variables with potential in approaching long bone levels of accuracy, two methods are used to reduce the data set for discriminant function analysis. The mean ratio method compares male to female mean ratios of variables to those of long bones. The zero probability method selects elements with zero probability t-test scores. Results of discriminant functions are 5-10% better for the zero probability method.

Finally, automatic and interactive step-wise and complete discriminant analyses are used to determine which method is more effective in the final selection of variables that successfully contribute to the model. Interactive step-wise discriminant analysis is most effective. The most diagnostic tarsal is the talus and the most diagnostic carpal is the lunate. Long bone discriminant functions are 92% accurate for the Windover sample used while tarsal and carpal discriminant functions are between 94%-100% accurate. Applications of sex estimation using tarsal and carpal data are valuable for osteologists as these small dense bones have greater incidences of survival in the archaeological record, particularly in places with poor preservation. This research suggests an alternate method of sex estimation that has high potential in sites where traditional long bone and cranial data may be unrecoverable. While acknowledging the limitations of research conducted on a prehistoric population of unknown sex, the results of this study indicate the necessity of further research on a collection with known sex.

The Mousterian human remains from Zafarraya (Andalucia, Spain). J.J.HUBLIN (UMR152 du CNRS, Paris), E. TRINKAUS (Dept. of Anthropology, Washington University, Saint Louis and URA 376 du CNRS) and V.H. STEFAN (Dept. of Anthropology, University of New Mexico).

The human remains from the site of Zafarraya are the most recent unearthed in Western Europe in a Middle

Paleolithic (Mousterian) context. They are dated circa 33.5 ky BP (by C14) and are roughly contemporary with the late Neandertals of Saint-Césaire and Arcy-sur-Cure found in early Upper Paleolithic (Castelperronian) contexts. The series includes a fairly complete and a fragmentary mandible, a fragmentary femur, a pubic bone and a series of isolated teeth. Comparative discrete morphology and discriminant function analysis consistently assign the mandibular and dental remains to the Neandertals (*sensu lato*) and separate them from earlier Upper Paleolithic modern humans. In particular, the Zafarraya 2 mandible displays relatively large bucco-lingual dimensions of the anterior dentition and conditions commonly observed in the Neandertals (*sensu lato*) in anatomical areas such as the symphysis, mental foramen, retromolar area, condyle and sigmoid notch. Despite a relatively narrow symphyseal body, the Zafarraya male pubic bone exhibits the characteristics of a male late archaic human best documented for the Neandertals (large sub-pubic angle and relatively narrow pubic ramus). The proximal femur is relatively gracile for a Neandertal, falling in the range of overlap between European Neandertals and early Upper Paleolithic Moderns for some metrics. It nevertheless lacks a pilaster, which distinguishes the first group from the second. The site of Zafarraya provides clear evidence of the late persistence of Mousterian industries between 35 and 30 ky BP in the southern part of the Iberian Peninsula, where early Aurignacian is not documented. It also proves the Neandertal nature of the final Mousterian toolmakers in this area.

This research was funded by the CNRS, Collège de France, French Ministry of Foreign Affairs, the Junta de Andalucía, the Patronato de la Cueva de Nerja, the Diputación provincial de Málaga and the Leakey Foundation.

Lower limb skeletal structural adaptation in Upper Paleolithic and Mesolithic Europeans. B. Holt, Dept. Anthropology, University of Missouri, Columbia MO 65211

Temporal changes in structural strength of 82 femora and 64 tibiae from Upper Paleolithic and Mesolithic European populations were evaluated by measuring bone geometric sectional properties at three locations, proximal (80%) and midshaft femur and tibia (50%). Sections were reconstructed using a combination of biplanar radiographs and subperiosteal molds. The sample was divided into Early Upper Paleolithic (EUP), Late Upper Paleolithic (LUP), and Mesolithic (MESO) subgroups. Cross-sectional properties were standardized by powers of bone length adjusted for body breadth.

In the proximal femur, males show an increase in cortical area (CA), antero-posterior (A-P) bending strength, as well as torsional strength (J). Females exhibit a small increase in CA and bending strength in the LUP, but a decrease in MESO.

Both male and female midshaft femur and tibia increase in CA and torsional strength, most significantly in the LUP. Femoral and tibial A-P and M-L bending strength increases in both sexes,

although MESO females decrease slightly. Analysis of shape ratios of A-P and M-L bending (I_x/I_y and I_{max}/I_{min}) indicate that male and female proximal and midshaft femora became more circular in cross-section through time, while the shape of midshaft tibia became less circular, and more A-P oriented.

The increase in relative strength of the femur and tibia between EUP and LUP is interpreted as an increase in mechanical loadings of the lower limbs, a change that parallels that found in the upper limbs. These results indicate that the lower limbs of Late Upper Paleolithic Europeans were designed to resist high levels of mechanical stress, perhaps a reflection of conditions present during the Glacial Maximum. These conditions may have led to an increase in activity levels, a consequence of increasing unreliability of available resources. Alternative, and not necessarily exclusive, explanations, will be discussed, including age as well as the effect on skeletal structure of an increase in body breadth from EUP to LUP. Supported by the National Science Foundation and the L.S.B. Leakey Foundation

Non-destructive Computerized Tomographic investigation of a saponified body from the late 18th century. DAVID R. HUNT and BRUNO FROLICH, Department of Anthropology, National Museum of Natural History, Washington, DC 20560.

National Museum of Natural History (NMNH), Department of Anthropology, Physical Anthropology Division specimen #381236 died in the Yellow Fever epidemic of 1792 in Philadelphia, PA. The fairly complete body is preserved by saponification, a chemical conversion of fatty tissues and lipids into a stable state. The individual was most likely buried in a high water-table area, since the saponification is consistent with preservation seen in submerged bodies. The remains were disinterred in 1825 when the cemetery was relocated and subsequently became part of the Wistar Institute collections until 1958 when it was transferred to the NMNH. Wistar records (#4249) report the remains were of a named European male, 63 years of age. However, there has been some dispute as to the accuracy of this identification.

Previous studies of this specimen had been made by plain film radiography. Overlay of internal features had greatly restricted accurate interpretations of the skeleton and internal structures. To more precisely study the internal morphological structures of this individual without destruction of the specimen, two millimeter transverse computerized tomographic slices were taken from head to foot using the Siemens Somatom AR.T scanner housed at the Anthropology Department, NMNH. Siemens Recon Plus software and Multiple Planar Reconstruction were used to electronically reconstruct oblique slices from the transverse tomograms. The entire skeleton was then displayed in coronal slices for measurement and morphological analysis. Results of this examination indicate a caucasoid male between 45 - 60 years of age. Internal organs were also reconstructed for investigation and to test and modify the techniques generally used to reproduce these features. Adjustments in the kVp, mA and time were recorded and experimentation of the window and center values for display systems as well as shifts in algorithm values for producing the images were recorded. The internal organs are surrounded by saponified material and the internal structures are still observable using special oblique views.

With ongoing collaboration between Siemens Medical

Systems and NMNH, the results from this examination have assisted in setting standards for this type and other forms of non-medically related, less traditional investigations utilizing Computerized Tomography.

Variation in emergence of deciduous dentition in a group of captive infant gorillas (*Gorilla gorilla*). A. BELLISARI, Department of Sociology and Anthropology and Department of Community Health, Wright State University, Dayton, OH 45435

Longitudinal data on growth and body composition were collected in a small group of nursery-reared infant gorillas at the Columbus (Ohio) Zoo. The group included two sets of full siblings--a pair of male twins and a male-female pair. All six infants had one set of grandparents in common. Nursery records showed that the female and two of the males suffered from intestinal symptoms of varying duration and severity which may have affected skeletal growth and body composition (Bellisari, Greenberg and Towne, unpub). One male had a serious case of malabsorption lasting from birth until age 5 months, and the other male suffered intermittent intestinal symptoms and a *Salmonella* infection at day 250. The twins and another male had no record of illnesses. Nursery records also provided data on the eruption of deciduous teeth.

Age in Days at Emergence of Deciduous Teeth

	Female(n=1)	Males (n=5)
lower central incisor	23	22-76
upper central incisor	45	48-136
upper lateral incisor	62	76-156
lower lateral incisor	71	70-137
upper 1st molar	97	124-228
lower 1st molar	110	165-254
lower 2nd molar	243	182-380
upper 2nd molar	269	193-394
upper canine	276	328
lower canine	276	395

Variation in age-at-emergence was greater for deciduous molars than for deciduous incisors. Teeth appeared earlier in the female than in the majority of males. Age-at-emergence for incisors was virtually identical in the twins. One of the males with serious intestinal symptoms manifested the latest emergence of deciduous incisors, but the infant with severe malabsorption followed by recovery had the earliest eruption times among the males, with age-at-emergence preceding or coinciding with the female (not his sibling) for most of the teeth.

In this small group of infant gorillas variation in the emergence of deciduous dentition may reflect genetic differences, but seems to be unrelated to health and nutritional status in infancy.

With thanks to the administration and staff of the Columbus Zoo for their assistance and cooperation.

The Degree and Nature of Sexual Dimorphism in *Homo erectus*. A Comparison of the Partial Hipbones of OH 28 and KNM-ER 3228. G.C. Cabana, 4009 Ruthvens Natural History Museum, University of Michigan, Ann Arbor, MI 48109.

Models of human evolution that intertwine assumptions about behavior and biology commonly lay on

the cornerstone assumption of a high degree of sexual dimorphism in early *Homo*. In the tendency to view human evolution as a continuum from highly dimorphic australopithecines to relatively less dimorphic modern humans, we assume that sometime during hominid evolutionary history, humans experienced a changing pattern of selection acting upon sexual dimorphism. But what was the degree and nature of sexual dimorphism in early *Homo*?

Particularly relevant to this question are two isolated partial pelvic bones taxonomically ascribed to *Homo erectus*: OH-28 and KNM-ER-3228. Modern sexing criteria indicate they are, respectively, a female and a male. Yet, in terms of body size estimates and indicators of robusticity, these fossils show little difference. This paper first determines whether OH 28 and KNM-ER 3228 can be said to represent female and male *H. erectus* by reviewing modern sexing criteria and their possible application to the fossil record. Second, it will assess (1) the nature of sexual dimorphism in *Homo erectus* in aspects of body size, robusticity and obstetrically related features; and (2) the degree, or magnitude, of dimorphism, based on a comparison to two different modern human population groups.

OH 28 and ER 3228 seem to exhibit obstetric differences that agree with their original sex designations. My data suggest no significant overall body weight difference, but there appears to be a difference in the distribution of body weight. The specimens also seem to exhibit little difference in robusticity. I would suggest that based on these data, the best hypothesis is that relative to modern humans, *H. erectus* probably had a different overall pattern of dimorphism than modern humans.

Temporal and Spatial Variation in the Patterns of Treponematoses in *La Florida*. D.L. HUTCHINSON, East Carolina University, Greenville, NC, 27858, C.S. LARSEN, University of North Carolina, Chapel Hill, NC, 27599-3120, M. WILLIAMSON, Purdue University, Lafayette, IN, 47907, and V.D. GREEN CLOW, Geo-Marine, Inc., Plano, TX 75074

An impressive number of precolumbian treponemal cases have been documented for Florida, beginning with Hrdlička's 1922 report of postcranial inflammatory lesions suggestive of syphilis and later in Bullen's 1972 survey of Florida skeletal remains exhibiting postcranial and cranial lesions suggestive of syphilis.

We integrate those early studies with additional data from skeletal series dating between 400 B.C. and A.D. 1800 from Florida and Georgia. Lesions are classified in order to document the variability of osseous expression. This study draws from previously published observations and the authors' examination of 90 skeletal series.

Evidence of treponematoses from Georgia comes primarily from Irene Mound (Powell 1990), although two additional cases are reported for the Chauga series. Forty-two cases of probable treponemal infection are reported from Florida series. Although some variation in expression of the disease is present, it does not appear to be outside of the variation present in the observed patterns of the modern treponematoses.

Of the modern treponemal syndromes, the pattern and

expression of lesions in the Florida and Georgia series are most like those of yaws and endemic treponematoses. We observed no dental stigmata suggestive of congenital transmission. The continuity in skeletal expression in the Georgia and Florida series argues for some continuity in disease pathogens and host populations.

This research was supported in part by grants from the National Science Foundation (BNS-8406773, BNS-8703849, and SBR-9305391) and the University of Georgia to CSL and the University of Florida, the University of Illinois, and private donations to DLH.

The effects of reproductive history upon post-menopausal bone mineral density and incidence of fracture frequency, location and type to distinguish between type I and type II osteoporosis in the Arizona Bone Density Study. A.K. Huxley, University of Arizona, Tucson, AZ. 87528.

Over the last fifteen years, researchers from the Arizona Bone Density Study have collected data on the general health, nutrition, reproductive history (of women), bone mineral content (BMC) and fracture history from 4415 subjects in a mixed longitudinal and cross-sectional study. Of these, 3140 women and 1222 men will form the major components of this analysis. Data collected from the female participants are used to assess the relationships between reproductive history, post-menopausal BMC and fracture frequency, location and type. These data are then compared to bone indices and fracture frequency, location and type in males.

Of this initial series, the average age for females is 70, with the range between 50-100 years. The average final BMC is 0.7 g/cm² and distal third radial width is 1.3cm. These women have variable reproductive histories. Average age at menarche is 13 years and menopause is 47 years creating an average reproductive span of 34 years. Of these 3140 women, 40% never became pregnant, 60% became pregnant at least once and very few did not code this information. Total duration of pregnancy ranged from 1-135 months, with an average of 24 months. Of these 1864 subjects, 54% breastfed at least one week, the average is 10 months and the range is 0.25-132 months. When both variables are combined together, the average is 29 months, while the range is 1-180 months.

Incidence of first fracture in females is 29% at an average of 65 years. The two most frequent sites are the wrist (23%) and ankle (20%), with fracture due to fall (66%) and accident (17%). Rate of second fracture is 9% at 69 years of age on average. The two most common sites are the wrist (23%) and ankle (17%), again primarily due to fall (66%) and accident (17%). Third fracture frequency is 4% at roughly 73 years of age. Fracture locations shift to the wrist (19%), the ribs (15%) and vertebrae (15%). Third fractures are due to fall (62%), other (18%) and accident (15%). Finally, 1% had fourth fracture at an average age of 74 years. The most common locations include the vertebrae (24%), ankle (13%) and hip (11%), as caused by fall (60%) and accident (19%).

In comparison, the average age of males is 75 years. The BMC is 1.1 (g/cm²) and the distal third radial width is 1.6 cm. Incidence of first fracture is roughly 17% at an average age of 63 years. The three most common sites are the ankle (18%), ribs (17%) and wrist (17%) due to fall (49%) and accident (34%). Second fracture occurred in roughly 3% at a mean age of 67 years. Frequent locations include the ribs (32%), vertebrae (14%) and shoulder (11%) due to fall (54%) and accident (24%). Roughly 0.5% had third fracture at a mean age of 65 years (value due to sampling) in the arm, wrist, fingers, ankle and toes equally. These were caused by accident (60%) and fall (40%). Only 0.2% of these subjects had fourth fracture at an average age of 78.5 years, which occurred in the arm (50%) and hip (50%) due to accident (50%) and fall (50%).

Right and left hand use preferences in a power grip task among *Pan paniscus* at Wamba, Zaire. E.J. INGMANSON, Dickinson College, Carlisle, PA 17013.

The evolutionary origins of human handedness and brain asymmetries may have had important implications for the emergence of language and tool using behavior in our ancestors. Data from extant great apes can assist in understanding these associations by providing information on the context of hand preferences, individual variation, and differences between tasks. This study was conducted with a population of *Pan paniscus* at the site of Wamba, in the former Zaire, during 1987-88. As part of a project to examine the object manipulation and tool using behavior of this species in the wild, data were collected on individuals from two separate unit groups. Various tasks were identified in which it might be possible to identify hand use preferences. One of these was the peeling of sugar cane, where one hand is used in a power grip and the other for small manipulations.

Results from this study show some very interesting patterns of variation. Across the entire population examined, almost equal numbers of individuals used the right hand, as used the left for the power grip. No differences were apparent between males and females. However, individuals tended to be very consistent in the use of either the right or left hand. In addition, within a unit group, individuals tended to be consistent with each other. In the E1 group, most individuals used their right hand for the power grip, while most individuals in the E2 group used their left hand for the power grip. This last finding suggests the possibility of genetics or learning influencing hand preference.

The research was supported by the Wenner-Gren Foundation, NSF, and the Japan Society for the Promotion of Science.

Correlation of serial homologues in hominoids: implications for the evolution of hominoid hands and feet. S. E. INOUE, Ohio University, Athens, OH 45701 and C. O. LOVEJOY, Kent State University, Kent, OH 44242.

The hand and foot share a similar basic pattern of HoxD and HoxA expression, which accounts for much of the overall structural similarity between them. Additional alleles including Hox genes of other clusters and the T-box genes are differentially expressed in the fore and hind limbs, and are therefore potential candidates for explanations of fundamental differences between them. However, it is also clear that additional, more downstream alleles with less extensive morphological effects, such as those involved in disorders such as brachydactyly, are also shared

because they produce simultaneous effects in the hand and foot. Such communality of genetic determination has not been given sufficient attention in accounts of the evolution of the hand and foot in primates.

One relatively simple morphological character whose genomic basis may involve substantial sharing of downstream alleles in both the hand and foot is bone length. If this is the case, then a considerable reworking of current adaptive scenarios about hominoid hand and foot evolution may be required. This would include, in particular, the potential coevolution of the metatarsus and metacarpus in hominoids, and especially the australopithecines.

We investigated the probability of such codetermination in hominoids by calculating partial correlation coefficients for homologous elements of the hand and foot in living hominoids. We reasoned that if significant correlations between homologous elements could be maintained while controlling for body size effects (i.e., by partial correlations), such results would strongly support the hypothesis of a significant shared component of bone length in the metatarsus and metacarpus. Our results, obtained from an analysis of large samples of living hominoids, strongly support our hypothesis.

This research was made possible by support from NSF (BNS-9000964) and Northwestern University (0100-510-152Y).

Potential early prehistoric human remains from Jalisco, Mexico: A revised assessment. J.D. IRISH, Department of Anthropology, University of New Mexico, Albuquerque, NM; J.E. LOBDELL, Department of Biology, University of New Mexico, Albuquerque, NM; S.D. DAVIS, USDA Forest Service, Sitka, AK; F.A. SOLÓRZANO BARRETO, Museo Regional de Guadalajara, Instituto Nacional de Antropología e Historia, Guadalajara, Jalisco, Mexico.

Collections of Late Pleistocene faunal remains have been made in the Chapala and Sayula lake and playa complexes of Jalisco, Mexico, since 1840. Expansion and contraction of lake and playa size has led to an availability of these redeposited remains into recent years. Many species have been identified, including mammoth, mastodon, horse, bison, camel, deer, and ground sloth, plus a host of other fauna representing formerly-rich inland lacustrine environs. Most faunal elements are pseudomorphic; bone tissue has been completely replaced by highly-concentrated minerals. Also found around these various lake remnants are early projectile point styles, including Clovis.

Recently, 30 fragmentary elements have been positively identified as human remains. Twenty such elements were recovered near Zacoalco, at a playa 50 km south of Guadalajara. An MNI estimate suggests the presence of at least three individuals ranging in age from subadult to elderly. The remaining elements were found just to the north, near Lake Chapala. MNI estimates suggest these remains also represent three individuals, from 3± years to adult in age. One

adult is distinguished by cranial rugosity, as evidenced by a massive supra-orbital torus with extensive lateral pneumatization. Such morphology is exceptional in the New World although not unknown, as evidenced by the Brazilian Lagoa Santa calotte, at an extreme end of the spectrum, and Chimalhuacan, at the other.

Although all of the human elements display heavy mineralization, a molar in a mandible fragment from Zocoalco contained enough organic material to allow Accelerator Mass Spectrometry dating; a chronometric study of this material is underway. These osteological data, together with paleontological, archaeological, geoarchaeological, paleoecological, and chronometric evidence, and our review of studies undertaken since the 1940s, are promising to better reveal early human occupation in the interior plateau region of Mexico.

Biocultural analysis of a forensic skeletal collection. M.Y. IŞCAN, 727 NW 7th Drive, Boca Raton, FL 33486, S.R. LOTH, Department of Anatomy, University of Pretoria, Pretoria 0001, South Africa, and E.N. L'ABBE, Department of Anthropology, Florida Atlantic University, Boca Raton, FL 33431.

Just as prehistoric finds are analyzed for data about the cultural as well as biological aspects of the inhabitants, forensic remains allow similar observations of the current populace with the distinct advantage of verifying conclusions when victims are identified. In archaeologic assemblages, technological assumptions are made from such findings as arrows and healing trephinations in the same way that the skeletons of modern people exhibit bullet holes and surgical pins in healing fractures. In both situations, there is also the question of representativeness - how well does the array reflect the demographic distribution of a region. Therefore, the purpose of this paper is to analyze the demographics, biological characteristics and technological aspects of a forensic sample.

The sample consists of the remains of 43 individuals from several medical examiner's districts in Florida. The skeletal material was examined for biological and demographic characteristics, antemortem pathology, and cause of death. The analysis revealed 38 adults (25 males, 13 females), mostly in their 20s and 30s, and 5 subadults. When cause of death or injury could be ascertained from the bones, of the 16 individuals exhibiting trauma, most were traced to projectiles from a variety of firearms. The rest were attributed to knives, screw drivers, blunt objects, and even shark attack. Antemortem medical intervention was evidenced by a stainless steel plate embedded in a healing femur with well developed bony apposition, a surgically wired sternum, partly obscured by bony overgrowth following heart surgery, and a healed mandibular ramus accompanied by dental repair with gold bridges. Many cases showed dental work - fillings, caps and dentures. Skeletal anomalies included a mandibular torus, polydactylous first tarsal phalanx, and spina bifida.

In conclusion, a forensic sample reflects important aspects of the people of today. Culturally, it highlights current weaponry, and the status of medical and dental technology. Familiarity with skeletal anomalies and healed trauma are vital to identification because they are factors of individualization. In some ways, a forensic array cannot be considered representative since the demographic distribution is heavily skewed toward young adults and males. In contrast to archaeologic finds, there was no evidence of active infectious disease.

Patterns of cortical bone remodeling in Inuits and Pueblo agriculturists. U.T. IWANIEC, University of Wisconsin, Madison, WI 53706, T.D. CRENSHAW, University of Wisconsin, Madison, WI 53706, M.J. SCHOENINGER, University of Wisconsin, Madison, WI 53706, S.D. STOUT, University of Missouri, Columbia, MO 65211, and M.F. ERICKSEN, George Washington University, Washington, D.C. 20037.

The current study provides a critical evaluation of the histomorphometric evidence for sex differences in cortical bone remodeling between Inuits (late 1700's to early 1900's), a primarily meat-eating people inhabiting the arctic and subarctic regions of North America and Greenland, and Pueblo agriculturists (900's to the 1600's) from the American Southwest. Secondary osteons and secondary osteon fragments were counted in two 1 mm wide columns spanning from the periosteal to the endocortical surface in anterior mid-diaphyseal femoral histological sections of 51 Alaskan Inuits and 61 Colorado plateau Pueblo agriculturists. Results were analyzed using ANOVA. Although Inuits exhibited higher total osteon (secondary osteons + osteonal fragments), secondary osteon, and osteonal fragment densities than Pueblo agriculturists, pooled across all age groups, the differences were not significant even when sex, age, and the potential interactions of sex and age were taken into account. Differences were, however, noted between middle-aged (30-50 years old) females in the two groups. Middle aged Inuit females exhibited significantly ($P < 0.05$) higher total osteon, secondary osteon, and osteonal fragment densities than Pueblo females. The osteon density patterns imply a history of greater anterior mid-diaphyseal femoral remodeling activity among the Inuit females. We propose that the effects of pregnancy and lactation in association with probable fluctuations in food availability and variables peculiar to the Inuit diet (e.g., high acid content) best account for the cortical bone remodeling patterns observed. This work was supported by an NSF Dissertation Improvement grant #OPP-9220737 (MJS and UTI) and two Sigma Xi Grants-in-Aid of Research (UTI).

Condylar region morphology in Neandertal mandibles: issues of ontogeny, homology and interpretation. R.S. JABBOUR, Anthropology, City University of New York, NY 10036 and G.D. RICHARDS, Laboratory for Human Evolutionary Studies, U.C. Berkeley, CA 94720.

Among mandibular features proposed as diagnostic of Neandertals, the crest of the mandibular notch (CMN) has been described by several authors as running to the middle of the condyle in Neandertals and to the lateral end in modern humans. Most recently, CMN position in the Amud 7 infant has been used to argue that Neandertals are a separate species (Rak and Kimbel 1995). In order to illuminate the significance of this feature, we evaluated its expression in Pleistocene to Recent *Homo*.

We examined 24 casts of fossil *Homo* and a sample of geographically diverse Recent human adults ($n=102$) and subadults ($n=213$). CMN position is expressed along a continuum on the condyle's lateral half, and mandibles were scored on a scale of 1 to 4 (most to least lateral). Following the observation of a large lateral tubercle associated with Neandertal condyles, Recent human mandibles were also scored for tubercle size.

Among adults, 80% of Neandertals and 64.3% of Recent humans had less-lateral crests, scoring 3 or 4. Further, the largest lateral tubercles in our Recent human sample were all associated with less-lateral crests, suggesting a relationship between the large lateral tubercles and high incidence of less-lateral crests in Neandertals.

Our Recent human subadult sample revealed a complex pattern of CMN expression during ontogeny, indicating that infant and adult morphology in this region cannot be equated. The less-lateral crest of Amud 7 is in no way distinguished from the Recent human subadult sample. Understanding growth-related changes is a prerequisite to comparing adult and juvenile morphology and may also shed light on issues of homology in character analysis.

We conclude that CMN position is not diagnostic of Neandertals. The Neandertal CMN does not run to the middle of the condyle, nor does the modern human CMN run to the condyle's lateral end. Studies of lateral condylar tubercle etiology could enhance our understanding of Neandertal masticatory patterns and phylogenetic position.

Did syphilis exist in India before 1492?: A rebuttal to Rao and Vasulu. M. JACKSON, G.J. ARMELAGOS, Emory University, Atlanta, GA 30322.

Based on cranial lesions from archeological sites in India, Rao and Vasulu assert the existence of venereal syphilis in Southeast Asia prior to 1492. They claim a cranial fragment from Megalithic sites at Bhimbetka in Madhya Pradesh (dated 2000 BCE) shows lesions attributable to yaws. The second cranium found in Agripalle in Andhra Pradesh displayed a stellate scar resulting from ulceration and osteitis typical of venereal syphilis. Rao and Vasulu suggest a near 2% prevalence of syphilitic lesions in Southeast Asia based on these specimens from two of the 107 sites that have been investigated. We argue that Rao and Vasulu have failed to provide convincing evidence of treponemal infection prior to 1492.

Skeletal evidence of treponemal lesions must meet three crucial criteria. The lesion in the individual should exist in a pattern diagnostic of treponemal infection following acceptable criteria that have been established (Steinbock 1976; Rothschild 1993). There should be a number of individuals within the population that display the infection, and a number of populations within the region should display treponemal infection. The recovery of two isolated lesions in cranial remains that show postmortem deterioration recovered from 1560 skeletal specimens collected (.12%) hardly represents a pattern characteristic of a contagious disease. The evidence of syphilis in Southeast Asia prior to 1492 remains unconvincing.